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Food Security in Mountains : Challenges and Sustainable Strategies

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Abstract

The worsening global financial crisis threatens to perpetuate food insecurity that would result in widespread poverty world wide. The situation of food insecurity becomes particularly severe in communities that reside in isolated, far flung and inaccessible remote areas. The harsh climates and the difficult, often inaccessible, terrain combined with political and social marginality makes the mountain people more vulnerable to food shortages as compared to the other communities residing in the plains. In addition the indigenous knowledge about local foods and traditional agricultural practices in mountain areas is eroding and agricultural diversity as well as productivity is declining, further increasing the vulnerability of mountain people.

Hence, it becomes imperative to focus on approaches that ensure the availability of adequate and nutritious food for mountain people to lead healthy and active lives. This paper attempts to present sustainable approaches for livestock production, agriculture, forestry, fisheries, tourism and micro hydro power that need to be adequately implemented for ensuring food security along with a sustainable management of the local resources and the improvement in livelihoods of the people with an increase in their socioeconomic status.

Keywords: Food security, Mountain communities, Vulnerability, Indigenous knowledge, Sustainable

Paper Outline

Background

Deepening economic crisis, cutting of jobs, decline in production and lack of employment opportunities combined with a decreased purchasing power have perpetuated food insecurity world wide. The soaring food prices due to a combination of high levels of chronic hunger and a dependence on imports of grains and petroleum products have especially forced the people in developing and transition countries towards hunger and food insecurity.

The situation is particularly grave in mountainous communities on account of harsh climates and the difficult, often inaccessible, terrain combined with political and social marginality that make mountain people vulnerable to food shortages. A 2002 FAO study indicates that 90 percent of the world's mountain people (nearly 325 million) live in developing countries and as many as 245 million of these people (over 75 percent) are at risk of, or actually experiencing, hunger [2].

Mountains: Vital resources

Highlands and Mountains are vital economic and ecological resources, high in biodiversity and minerals alike. Although they occupy only a fifth of the earth's land surface [4] and house only a tenth of its human population, more than half of the world's population is reliant on them (Earth Summit -Agenda 21, 1992), in particular for water resources and agriculture biodiversity for food production. In developing regions many of the poorest of the poor live there. Mountain landforms trigger precipitation, which, coupled with the water-storage capacity of glaciers, give them a vital hydrological role. Three billion people in Pakistan, India, Nepal, China and the Indochinese peninsula depend on rivers that flow from the Himalayas. Similarly, many millions rely on the headwaters of the Amazon in the Andes, and on the Nile and Congo rivers, which flows from the East African highlands. In addition to water, 38% of the world's forests are located in mountain areas. Mountains are the prime source of most minerals, and hold a large portion of the earth's biodiversity, representing some 40% of the critical biodiversity surface area [4]. Mountains are also home to many indigenous peoples, with their valuable cultures and indigenous knowledge. Notwithstanding the enormous importance of these regions, many highland and mountain communities remain isolated, trapped in poverty and live at the margins of society [3].

Challenges faced by mountain communities

A significant proportion of mountain people live on less favored lands, such as in the upper watersheds of the Andes and Himalayas, and in the East African Highlands, where severe degradation of resources has been experienced [5]. Living far away from the centers of commerce and power, mountain people of the developing world exert little influence over the policies and decisions that influence their lives. Mountain nations such as Tibet, Lesotho, Nepal, Rwanda, Burundi and Ethiopia are among the 20 poorest in the world. In these regions, the majority of the population is under 18, and literacy varies widely, but is generally very low. Household income is also low – ranging from $150 to $500 per capita per year. Shocks, resulting from natural disasters or political actions, disease, war and market forces have profound impacts on the livelihoods of mountain people [6], and food insufficiency can vary from 1 week to more than three months per year. In areas where consecutive shocks are experienced -in the form of droughts, floods or pests -vulnerability is increased. Given that such events are frequent, food insecurity is a major problem with the result

that infant mortality ranges from 15 to 71 per thousand, and life expectancy is low, particularly for women [3].

Nutritional Status of mountain people and its implications

Nutrition studies indicate that mountain populations suffer from malnutrition and micro nutrient deficiencies. In a study from Peru [8], it was found that 43.7 percent of mountain children studied suffered from acute malnutrition (very thin children) compared to a national average of 36.5 percent. Similarly 13.4 percent of mountain children suffered from chronic malnutrition (stunted children) compared to a national average of 10.8 percent. Studies have also revealed that there is a discernible reduction of birth weight in babies born at high altitudes [9].

Iodine deficiency is also found in highlands and mountain areas. The combination of glaciation, melting snow and heavy rainfall in mountain areas can cause leaching, which depletes mountain soil, water and crops of iodine. The people of the Andes, Himalaya and Chinese mountain ranges are considered at highest risk [10], but iodine deficiency is also found in many European mountain areas. They are responsible for a range of conditions including increased pre- and post-natal mortality, goitre and cretinism. The effects on the intellectual development of individuals are seen as a major constraint to community and economic development in mountains. Data from the Himalaya and the Andes [11] also indicate a high prevalence of Vitamin A deficiency in mountain areas. This is likely due to a combination of poor food practices and limited access to foods that are rich in Vitamin A. When people have insufficient food to meet their minimum energy and nutrient needs, they are not able to enjoy a normal and healthy life. Infants with low birth weight (less than 2.5 kg) caused, *inter ali*a, by maternal malnutrition are at a greater risk of illness and death, impaired cognitive development and (for females) poor pregnancy outcomes later in life. Stunted baby girls grow into small mothers who in their turn deliver underweight babies. Children do not grow well and have more learning difficulties. Their immune systems are affected and they are less resistant to infections. In adulthood the accumulated effects of malnutrition can reduce labor productivity, which in turn limits the earning potential of households and communities. While at the individual level severe malnutrition is clearly a life threatening condition, at community level malnutrition results in reduced overall economic productivity [7].

Causes of poor nutrition in mountain communities

Nutritional deficiency disorders such as protein-energy malnutrition (PEM) and deficiencies of micronutrients such as iodine, iron and Vitamin A, are the result of numerous factors, including insufficient or inadequate intake of food, caused by poverty and/or inappropriate feeding practices [7]. Infections and parasitic diseases, which are linked to poor environmental sanitation and poor health and care practices and services, also contribute to micronutrient deficiencies. These factors are closely related to characteristics commonly found in mountain areas [7, 12, and 13]. In addition harsh climates and the difficult, often inaccessible, terrain combined with political and social marginality make mountain people more vulnerable to food shortages.

Some mountain people eat wild foods as a means of coping during periods of hunger and food shortages. However, in some cases these foods worsen their health. In Ethiopia, one such plant eaten during periods of famine is *nejiro*, which causes vision problems and headaches. Another is grasspea. When consumed in large quantities

over a period of months, its toxins can cause a debilitating disease known as lathyrism [14].

Given the miserable situation in which mountainous communities survive and the importance of mountain resources to the world as a whole. It is therefore urgent to warrant attention towards strategies for enhancing food security, livelihood options and sustainable resource management for poverty eradication in mountainous areas.

Food Security

Food security encompasses the ability to meet food and other household requirements by producing them locally or through sale of mountain products and services and thereby earning money to purchase the food and other household requirements.

Historically, different mountain communities occupied different ecological niches giving rise to distinctive cultures and ways of life (high mountain communities of hunters and gatherers; agropastoralists in the mountain slopes and highland areas; agropastoralists in the foot slopes and surrounding highlands; nomadic pastoralists in the highlands and lowlands). These communities were largely self-sufficient depending to a very limited degree on external trade [1]. However, the opening up of communication, population increases and resources scarcity due to resource exploitation has led to migration and changes in ways of life. Since the food security of mountain communities is linked to the food and incomes generated from livestock production, crop production, forestry, tourism and hydropower generation it is important to focus attention on these areas for sustainable development of the mountainous communities [2].

Livestock production

Livestock contributes to food security through sale of livestock products (meat, milk and leather) and in provision of manure that enhances soil fertility [1]. Nearly 70% of mountain land is used for grazing. Over 300 million people live on mountain grazing lands and depend on livestock for their food security. However, ever increasing population and growing demands for meat and diary products exert considerable pressure on pasturelands. Overgrazing results in deforestation, degradation of watersheds, increased green house gas emissions and the erosion of biodiversity.

An approach to address this problem is to encourage the producers to adopt sustainable livestock practices like the Regional Integrated Silvopastoral Ecosystem Management Project implemented in the mountains of Columbia, Costa Rica and Nicaragua. The farmers were persuaded to adopt sustainable silvopastoral practices such as planting trees, fodder shrubs and live fences in and around their pastures. In return they received 2000-2400 US $ per farm as payments for environmental services. Since the beginning of the project in Costa Rica the participating farmers have reduced the area of degraded pastures by more than 60 per cent. An estimated 25 000 tonnes of carbon have been removed from the atmosphere. More than 500 species of birds, one quarter of which are vulnerable or endangered have been observed on farms using these practices [2].

Further greater attention in breeding programmes is needed for indigenous (often endangered) livestock breeds that are adapted to mountain production systems [2]. This would ensure a large, healthy, superior livestock population in the mountains.

Crop production

Traditional and modern agriculture: striking a balance

By virtue of their shape and height, mountains are unstable places. At higher altitudes, soils form more slowly and are poorly anchored, making it more difficult to grow food than in fertile lowlands. Mountain plots also tend to be smaller while weather conditions are often more extreme, shortening the growing season and reducing yields. For these reasons, mountain environments are often best suited to subsistence farming rather than cash crop farming [14]. In the highlands of eastern and southern Africa, crop production accounts for over 80% of the local food needs. Tea, coffee, ananas, maize, barley, wheat, tef, rice, cassava, pyrethrum, horticulture are the major crops grown in these equatorial mountain areas. Even with the small farm holdings (<2 hectare per household) most families are able to meet their household requirements most of the times [1].

Generations of mountain farmers have learned to exploit fragile mountain environments sustainably by cultivating many varieties of plant species, terracing mountain hillsides and grazing animals over a wide area. In recent years, however, some mountain farmers have abandoned these age-old practices for modern, high-yielding farming methods [14].

Initial yields can be good, but delicate mountain ecosystems cannot always tolerate the amounts of fertilizers and pesticides required. Over time, these practices threaten the stability and sustainability of agriculture. In the Garhwal Himalaya in India for instance, studies conducted in the 1970s and again in the 1990s showed that, while yields of most traditional food crops remained stable, food shortages resulted when increasing numbers of farmers switched to high-yielding commercial crops [14].

Selection of nutritious foods decreasing

In some mountain communities, hunger is a consequence not only of food shortages but of inadequate food choices. When mountain farmers switch to high-yielding cash crops, dozens and sometimes hundreds of varieties of traditional foods can be replaced with one or two single varieties. In some instances, as in the case of flowers or coffee bound for international markets, the replacement crops are not even edible. In other cases, the large amounts of chemical fertilizers and pesticides needed to grow high-yielding crops damages surrounding biodiversity and nutritious secondary food sources. For example, traditional terraced rice fields in India and Nepal provide not only rice but fish and frogs, important sources of protein. But chemical fertilizers and pesticides kill off these nutritious food sources, leaving communities with less varied diets [14].

The problem of food insecurity is further compounded with the blind imitation of modern lifestyle; many traditional mountain foods become stigmatized as “foods of the poor”. Relatively cheap, high-fat, high-sugar products, such as sugary drinks, processed meats and white bread, are seen as more appealing, even if their nutritional value is very low [2].

Hence it is very important to tackle this highly complex and dangerous situation of crop production in the mountains which can have a devastating effect on this very fragile ecosystem.

First and foremost it is very important to enhance the awareness of the community through education and training on the nutritional value of locally grown and gathered food. It can help ensure adequate production of traditional foods that can meet the subsistence level of population. So, that the men and women, boys and girls in mountain areas are healthy and able to participate in the economic and social development of their communities. Further cultivation of local crops that are adapted to the local environment and are more hardy against the local diseases and infection and hence would require less inputs in form of chemical pesticides. Local crops would also derive fewer nutrients from the soils as compared to nutrient intensive cash crops. Hence, there would be considerable savings on the purchase of chemical fertilizers and pesticides.

An integration of agriculture and farming practices (traditional terraced rice fields in India and Nepal provide not only rice but fish and frogs, important sources of protein) would provide nutritionally rich diets for the people.

Food security and sustainable agricultural production in mountains will depend on farming communities employing affordable, environmentally friendly methods for conserving and replenishing soil fertility. An example of this is the Sustainable Soil Management Project in the midhills of Nepal. Using a farmer-to-farmer approach to agricultural extension, the project promotes sustainable soil management techniques, such as improved farmyard manure preparation and management and legume integration in the cropping cycle [2].

These practices have resulted in higher yields, better quality produce, improved soil conditions, lower expenditures on chemical fertilizers and higher incomes [2].

The Chagga home gardens in northern Tanzania “enable the farmer to sustain production with a minimum of external inputs, and thus provide a good model of land use for extrapolation to other areas with similar ecological and socio-economic characteristics. Management techniques applied today have been continuously refined and tested over the ages and handed down from one generation to the next. An average home garden of 0.68 ha produces about 125 kg of beans, 280kg of parchment coffee and 275 bunches of bananas.” Other fruits and vegetables, including maize and root crops, are also grown, the diversity ensuring that total crop failure never occurs. Fuel wood requirements are also partially met by home garden production [7].

Building markets for mountain products

Developing markets for niche products is seen as a key element in strategies for improving food security in mountain areas [2]. The following examples illustrate different approaches to building these markets. Through the Rawain Women’s Cooperative Federation, 2 800 women in India’s Central Himalayan Region are employed by agricultural microenterprises. Knowledgeable in traditional agricultural practices, which use no chemical inputs, the women have been able to capitalize on the growing demand for organic produce. The federation is marketing 18 different types of traditional crops in Indian cities, including buckwheat, horse gram and foxtail millet. A Japanese company has recently begun purchasing foxtail millet in bulk for preparation of baby foods. In the Anti-Atlas region of Morocco, saffron, also known as “red gold”, is a unique high-value mountain product. It is a key source of income for approximately 3 000 smallholder farmers who harvest the saffron at the end of

October, store it in safety boxes and sell it on the market during the course of the year as family cash needs arise. The Mountain Products Programme, which is implemented by FAO in the context of the Mountain Partnership, launched a project to support improved production, processing and marketing of saffron [2].

Fisheries

Fisheries particularly in the upper reaches of mountain streams are not widely practiced but have a considerable potential for enhancing food security. In western slopes of Mount Kenya, fresh water from mountain springs at favorable temperature is used for trout fish production [1]. Also dried products from fishes can be used for tiding off cold and harsh winters when other food commodities are difficult to obtain there by meeting the dietary requirements during adverse conditions. In addition a good approach would be to have the livestock areas on the topmost terrace followed by the fields and then the fisheries such integration would be highly beneficial as the livestock areas would provide waste rich in organic matter which would provide nutrients for the fields and the waste from the livestock and fields would provide nutrients and water for the fisheries downstream.

Forestry

Forests are important sources of fuel wood and charcoal for the mountain communities. However, fuel wood collection destroys the forests and woodlands, significantly impoverishing them and altering the habitat by the selective removal of preferred species. But, it is the charcoal making that is a major cause of forest resource degradation [1].

It would be important to adopt sustainable silvicultural practices where in designated areas should be specifically raised for fulfilling the fuel needs of the communities. The trees chosen should be fast growing, greater woody content and native to the area so that they may not become invasive. And the forests should not be destroyed for meeting the fuel needs of the population, fines could be imposed to discourage people from doing so and adequate policing (on rotation basis) comprising of women and children be employed to tackle the menace of illegal tree felling.

Collection of NTFPs (Non timber forest products)

Non-Timber Forest Products (NTFPs) play an important role in the livelihoods of the poor mountain communities, as a source of food, medicine, construction materials, and income [16].

Non-timber forest products (NTFPs) are a collection of biological resources derived from both natural and managed forests and other wooded areas. Examples include a variety of fruits, nuts, seeds, oils, spices, resins, gums, medicinal plants and many more products specific to the particular areas from which they originate [15].

Access to forest resources helps households diversify their livelihood base and reduce their exposure to risk. The earnings from forest products are often important as a complement to other income. And these assume importance often when farm production is not enough to provide self-sufficiency year round. Income from forest products is often used to purchase seeds, hire labour for cultivation, or generate working capital for trading activities. Hence, for the poorest households in mountains, NTFPs can play a critical role in providing both food and income [16].

Agrobased industries

The agro and food processing sector offers scope for development of several industries such as kinnow/ orange juice, malt extracts, floriculture and a host of other items. Besides these items like paddy husking, rice mill, mushrooms, tomato processing, other processing industries based on mango, pomegranate and other vegetable like onion, potato, garlic. Industries based on herbal and medicinal plants, sheep, goat, meat processing, poultry and poultry products and non edible oil processing industries have bright export prospects. Such industries can provide a steady source of income to the mountain youth right in their villages and can raise their standard of living considerably while ensuring food security.

However, it is required from the local government on its part to provide for training, technology up gradation, improvement in infrastructural facility and favorable government policies along with support from central government and the coordinated efforts of various institutions working in the filed of agro and food products [17]

Tourism

Vast areas have been set aside as national parks or reserves in mountain areas for their scenic beauty and for the protection of the endangered fauna and flora. These areas are important destination for tourists particularly in India, Kenya, South Africa, Ethiopia, Tanzania, Uganda, and Rwanda. These areas also contribute to food security through employment opportunities and in some case through programme aimed at revenue sharing between the park agencies and the communities there by providing an alternative source of income for the mountain populace [1].

Micro hydro power

Large quantities of water flowing from the mountain areas and favorable gradient make it possible to develop small hydropower plants. This presents opportunities for increasing local revenue which will ultimately contribute to enhancing food security along with providing cheap energy for isolated remote areas [1].

Climate Change

In the framework of climate change, temperature in mountain areas is expected to increase and the patterns of rainfall and snowfall would change. The incidence of extreme weather events such as storms, floods and avalanches is expected to increase. Higher temperatures and melting glaciers may bring about better agricultural conditions and facilitate the establishment of infrastructure, thereby increasing food supply. However, they also increase the risk of some kinds of weeds, pests and diseases that can jeopardize agricultural production and livelihoods. Biodiversity will inevitably be altered too, and many plant and animal species may become endangered. Coping mechanisms that once ensured food security may no longer prove effective. Furthermore, as permanent frost areas decrease, the risk of rock falls and landslides may rise. Disease-carrying organisms will also move upwards and be able to thrive in areas previously unfamiliar with such hazards. The local food and nutrition situation will therefore change as access to food, health and lifestyles change. Traditional wisdom may not be equipped to address these new elements and mountain residents may fail to realize the potential gains of a rapidly changing environment. It is therefore the need of the hour to undertake suitable steps worldwide to mitigate climate change **[7]**

Conclusion

Mountains are rich storehouses of biodiversity, minerals, forests and water, yet mountain people are among the world's poorest and hungriest. With rapid increase in population and the growing food insecurity the mountain ecosystems are under tremendous environmental pressure. Hence, it is important to address the challenges faced by mountainous communities in a sustainable manner. Sustainable approaches for livestock production, agriculture, forestry, fisheries, tourism and micro hydro power need to be adequately implemented in order to enhance the food security in mountain areas. In addition it is the need of the hour to undertake suitable steps worldwide to mitigate climate change as it would affect all ecosystems world over but the susceptible ones like mountain ecosystems would be even more badly affected as compared to the others.

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